9-3 Rotations

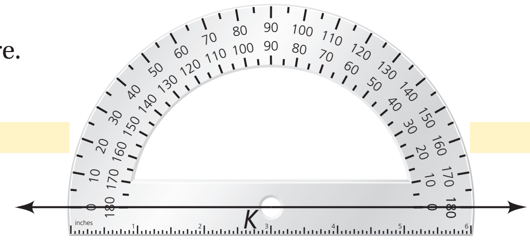
Vocabulary

Review

1. What is the name of the tool shown to the right? ____________

2. Draw a line segment to classify each angle measure. Then draw and label the angles on the tool.

90°	*acute* angle
25°	*right* angle
155°	*obtuse* angle

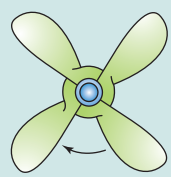


Vocabulary Builder

rotation (noun) **roh tey shuh n**

Related Words: transformation, preimage, image, center of rotation, angle of rotation

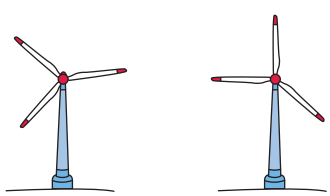
Main Idea: A rotation is a transformation which turns a figure about a fixed point called the center of rotation.



Example: A propeller is fixed to a boat or airplane at a center point. The blades rotate about that center of rotation. To map one blade of this propeller onto the next blade, rotate 90°.

Use Your Vocabulary

3. Tell if each pair of figures shows a rotation. Write *yes* or *no*.



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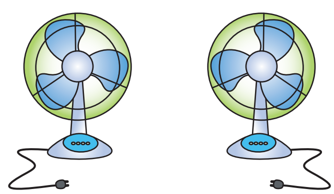

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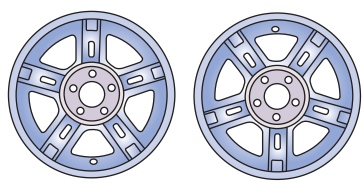

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Rotations preserve distance, angle, and orientation of figures.

take note

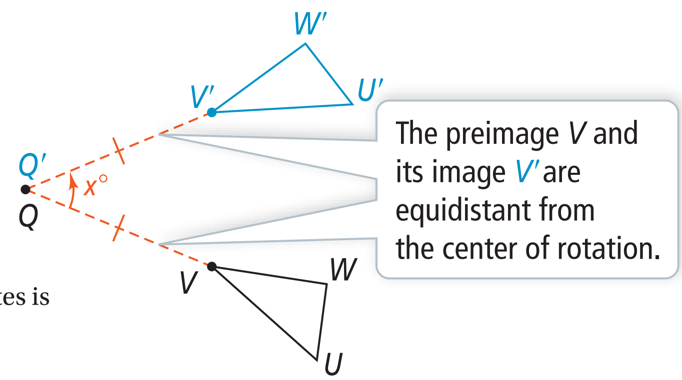
Key Concept Rotation About a Point

A **rotation** of $x°$ about a point Q, called the **center of rotation,** is a transformation with these two properties:

- The image of Q is itself (that is, $Q' = Q$).
- For any other point V, $QV' = QV$ and $m\angle VQV' = x$.

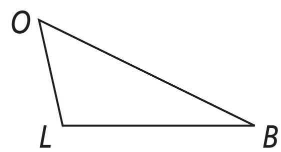
The positive number of degrees a figure rotates is the **angle of rotation**.

A rotation about a point is a rigid motion. You write the $x°$ rotation of $\triangle UVW$ about point Q as $r_{(x°,\, Q)}(\triangle UVW) = \triangle U'V'W'$.



Problem 1 Drawing a Rotation Image

Got It? **What is the image of $\triangle LOB$ for a 50° rotation about B?**



4. Fill in the blanks to develop your plan.

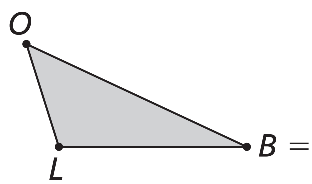
The image of point B is itself. So, $B' =$ ____.

The image of $\triangle LOB$ is ____.

I need to ____ $\triangle LOB$ ____ around point ____.

I will begin by drawing side ____.

Then I will draw side ____.



5. Circle the tools you will need to draw $\triangle L'O'B$.

ruler compass protractor calculator

6. Write T for true and F for false next to each statement.

____ To draw $\triangle L'O'B$, I will rotate the preimage clockwise.

____ The sides of the image must be congruent to the sides of the preimage.

____ I need to use the compass and protractor to draw only 2 sides of the image.

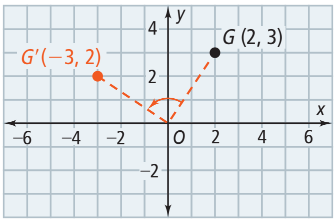
____ Each angle in $\triangle L'O'B$ is 50° greater than each angle in $\triangle LOB$.

When a figure is rotated 90°, 180°, or 270° about the origin O in a coordinate plane, you can use the following rules.

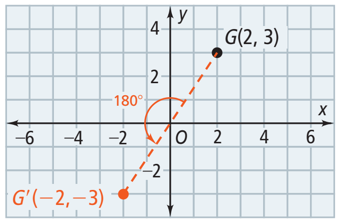
take note

Key Concept Rotation in the Coordinate Plane

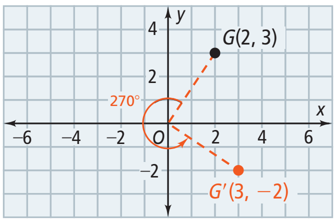
$r_{(90°,\,O)}(x, y) = (-y, x)$



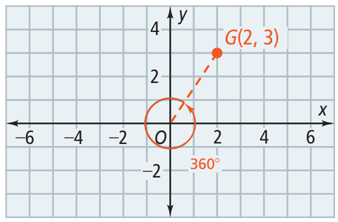
$r_{(180°,\,O)}(x, y) = (-x, -y)$



$r_{(270°,\,O)}(x, y) = (y, -x)$

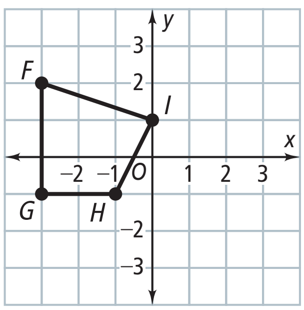


$r_{(360°,\,O)}(x, y) = (x, y)$



Problem 2 Drawing Rotations in a Coordinate Plane

Got It? **Graph $r_{(270°,\,O)}(FGHI)$.**



7. Circle the correct ordered pair you use to find $r_{(270°,\,O)}(x, y)$.

(x, y) $(-y, x)$ $(-x, -y)$ $(y, -x)$

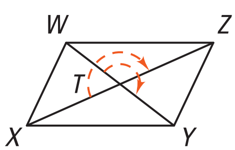
8. Use the rule you circled in Example 7. Fill in the blanks to find the coordinates for each vertex of the image and graph.

F': $r_{(270°,\,O)}(-3, 2) = ($ ___ , ___ $)$ G': $r_{(270°,\,O)}($ ___ , ___ $) = ($ ___ , ___ $)$

H': $r_{(270°,\,O)}($ ___ , ___ $) = ($ ___ , ___ $)$ I': $r_{(270°,\,O)}($ ___ , ___ $) = ($ ___ , ___ $)$

Problem 3 Using Properties of Rotations

Got It? **In the diagram, *WXYZ* is a parallelogram, and *T* is the midpoint of the diagonals. Can you use the properties of rotations to prove that *WXYZ* is a rhombus? Explain.**



9. Fill in the blanks or circle the word to complete each sentence.

A rhombus is a parallelogram / rectangle with two / four congruent sides.

To prove that *WXYZ* is a rhombus I need to show that $WX =$ ___ $=$ ___ $=$ ___.

Since the lengths of *WX*, *XY*, *YZ*, and *ZW* are known / unknown, you can / cannot use a rotation to prove that *WXYZ* is a rhombus.

Lesson Check • Do you UNDERSTAND?

Reasoning **Point $P(x, y)$ is rotated about the origin by 135° and then by 45°. What are the coordinates of the image of point P? Explain.**

10. Find the sum of the angles of rotation. Fill in the blank to complete the equation.

$135° + 45° =$ ______

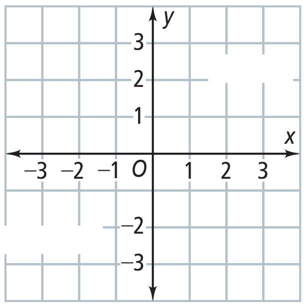
11. Match each rotation with the rule you can use to find the coordinates of the image.

$r_{(90°,\, O)}(x, y)$	$(y, -x)$
$r_{(180°,\, O)}(x, y)$	(x, y)
$r_{(270°,\, O)}(x, y)$	$(-y, x)$
$r_{(360°,\, O)}(x, y)$	$(-x, -y)$

12. Write the rule you need to use to find the coordinates of point P'.

____

13. Use the graph to show point P and its image, point P'.



14. Explain how you found the coordinates of the image of point P.

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Math Success

Check off the vocabulary words that you understand.

☐ rotation ☐ point of rotation ☐ angle of rotation

Rate how well you can *use the properties and rules of rotations*.